Network Features

... plug and play interconnect...

... intuitive interfaces ...

... Internet capable ...

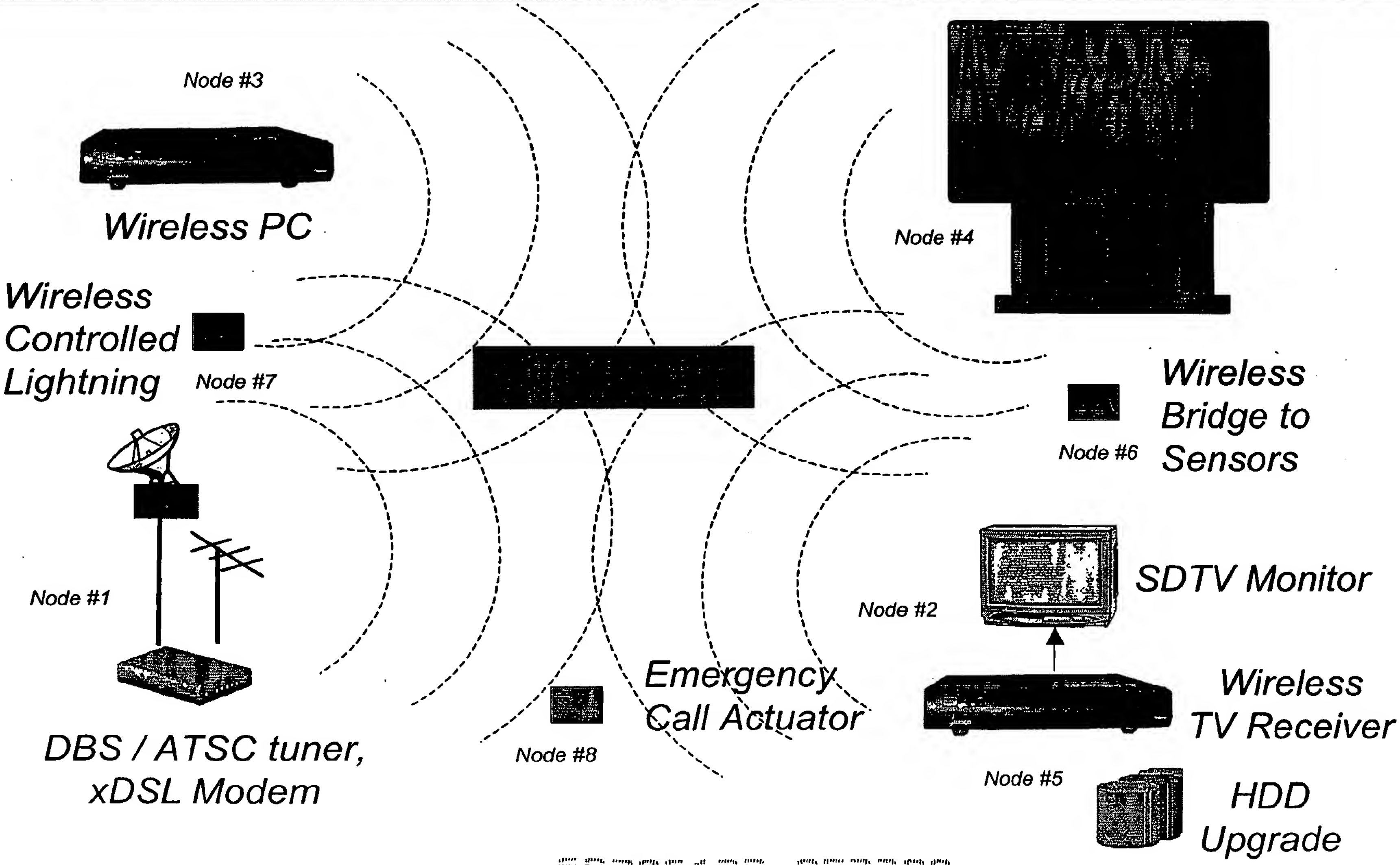
S / ATSC / xDSL and “open cable” suppo

... AOL compatible – “*make it easy to use; put it everywhere*” ...

FIG 1

The Network

FIG. 2



Node #3

Wireless PC

Wireless Controlled Lightning

Node #7

Node #1

DBS / ATSC tuner, xDSL Modem

Node #8

Emergency Call Actuator

Node #4

Wireless Bridge to Sensors

Node #6

Node #2

SDTV Monitor

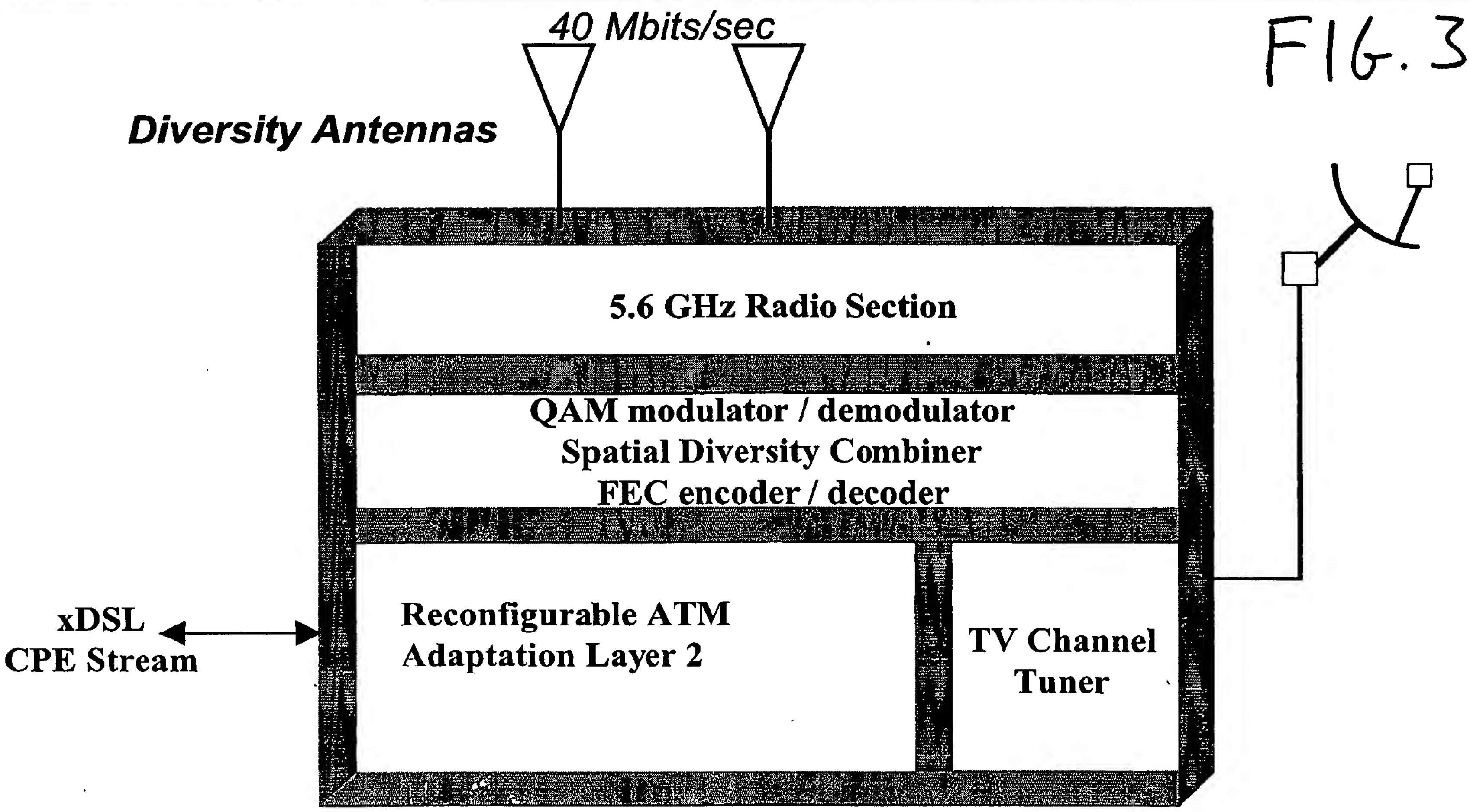
Wireless TV Receiver

Node #5

HDD Upgrade

Broadband Home Wireless Portal

FIG. 3

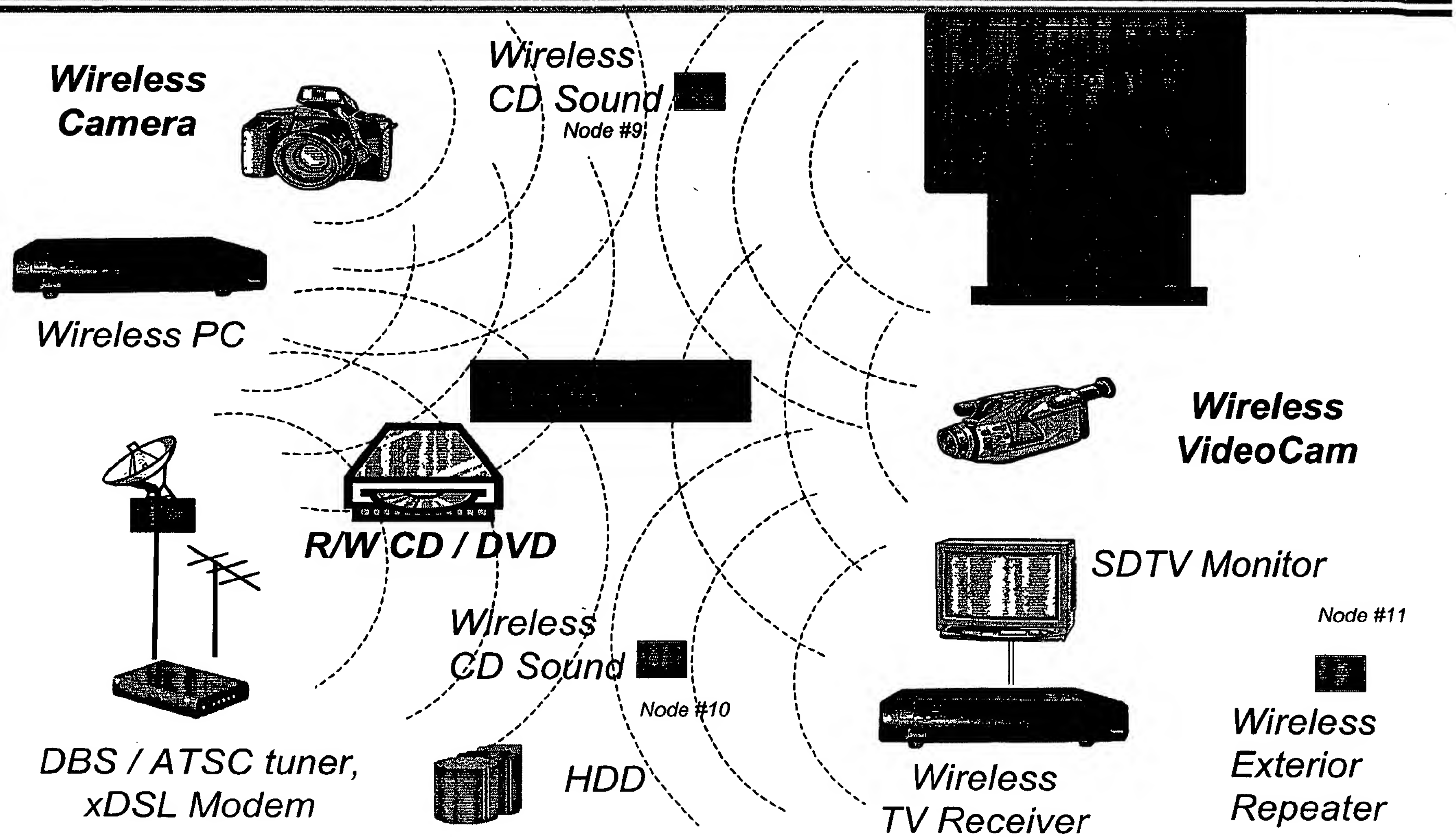


HDD Enables Home Services FIG. 4

- The HDD becomes the NATURAL repository for still images and video … wirelessly accessible from TVs and PCs
  - » Enables PVR
    - – time shift viewing
    - – snap-shot editing / print ordering / picture email
    - – video-clip editing / video email
    - – datacasting / e-commerce / impulse purchasing
    - – indexing by video content / video archiving
  - » Support service access via xDSL and / or satellite for home management systems

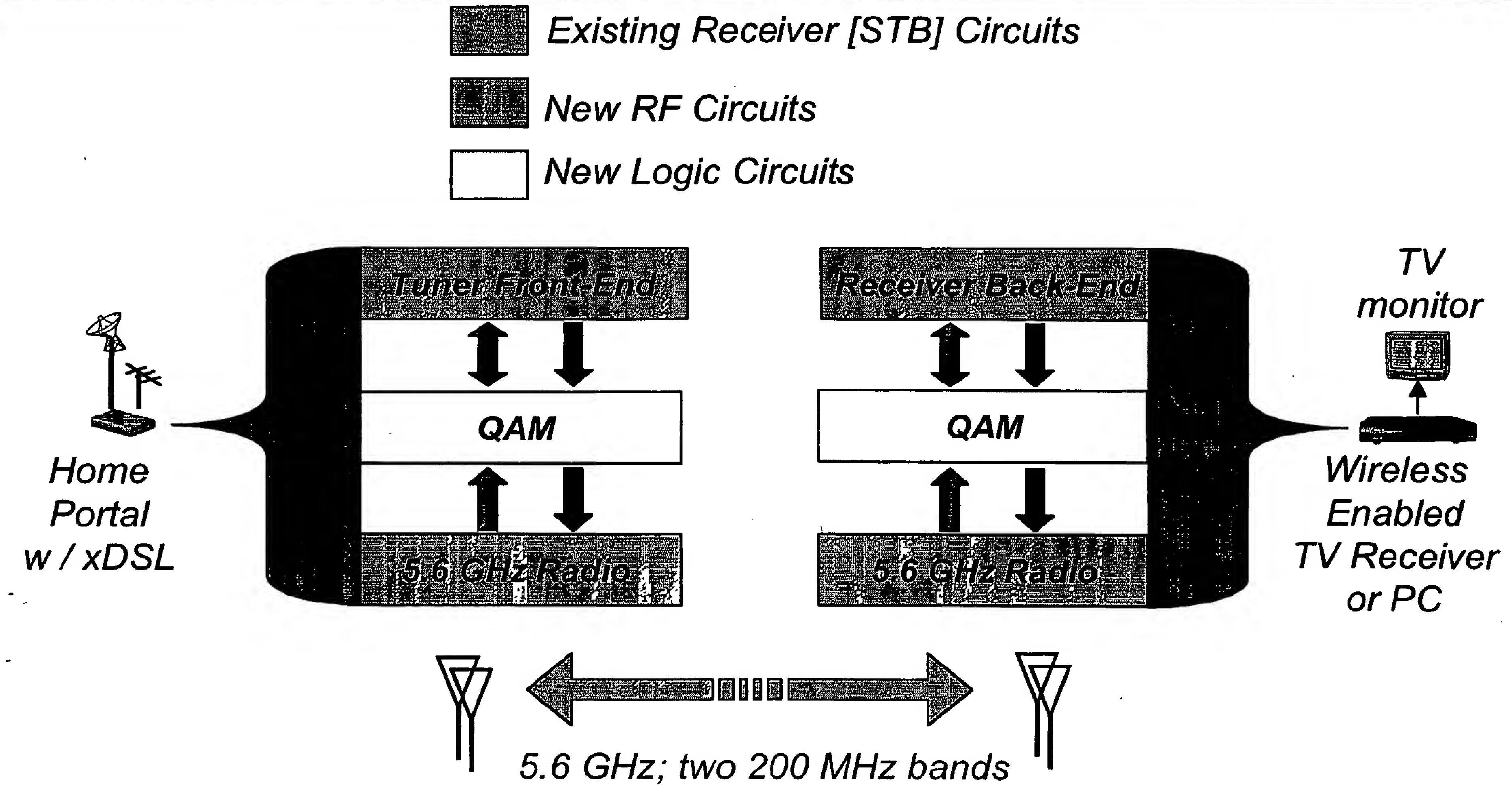
Expanded Network

FIG. 5



In–Home Architecture

FIG.6



▨ Existing Receiver [STB] Circuits

▨ New RF Circuits

☐ New Logic Circuits

Home Portal w / xDSL

Tuner Front-End

QAM

5.6 GHz Radio

Receiver Back-End

QAM

5.6 GHz Radio

TV monitor

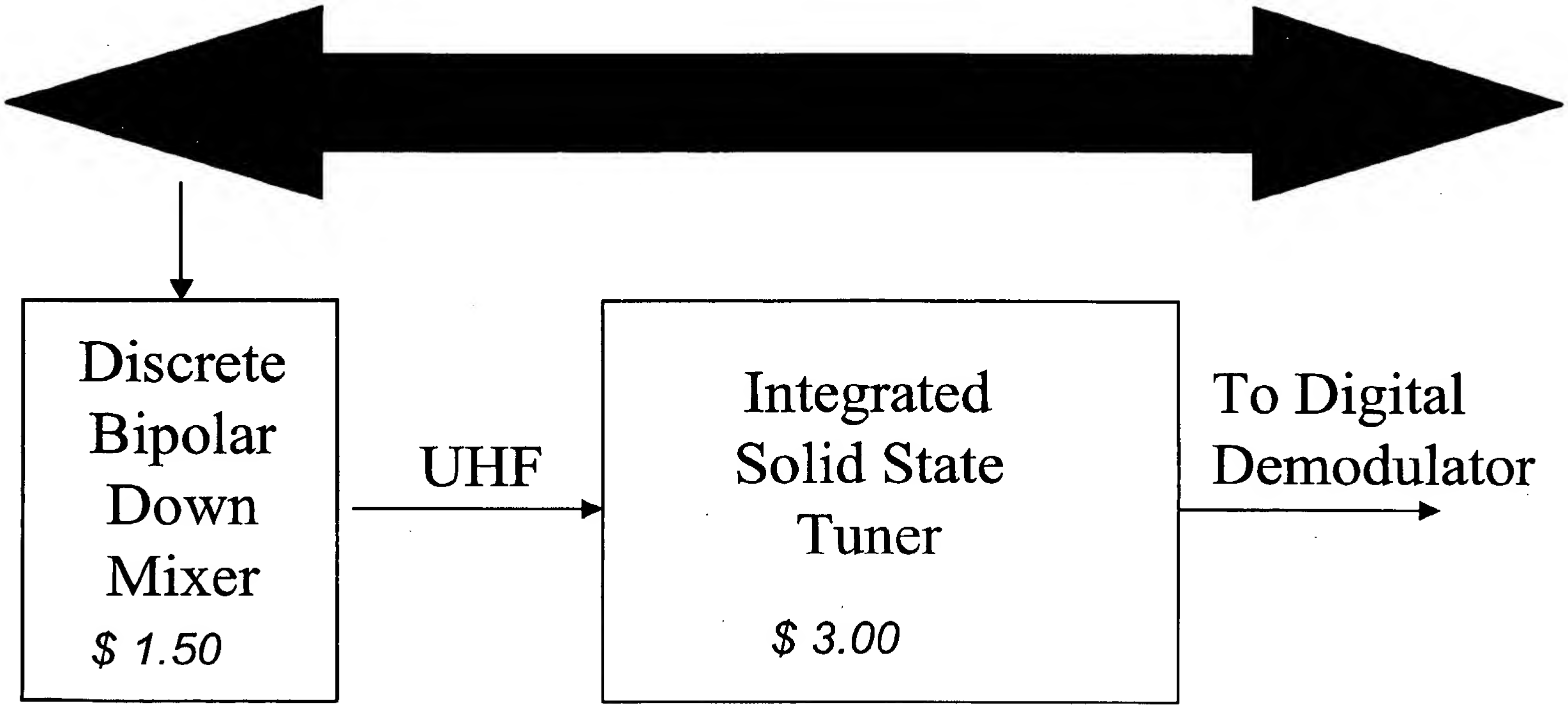
Wireless Enabled TV Receiver or PC

5.6 GHz; two 200 MHz bands

RF Radio Architecture

FIG 7

5.6 GHz Broadband
60 two-way channels
CSMA/CD
(carrier sense multiple access with collision detection)



Discrete Bipolar Down Mixer
$ 1.50

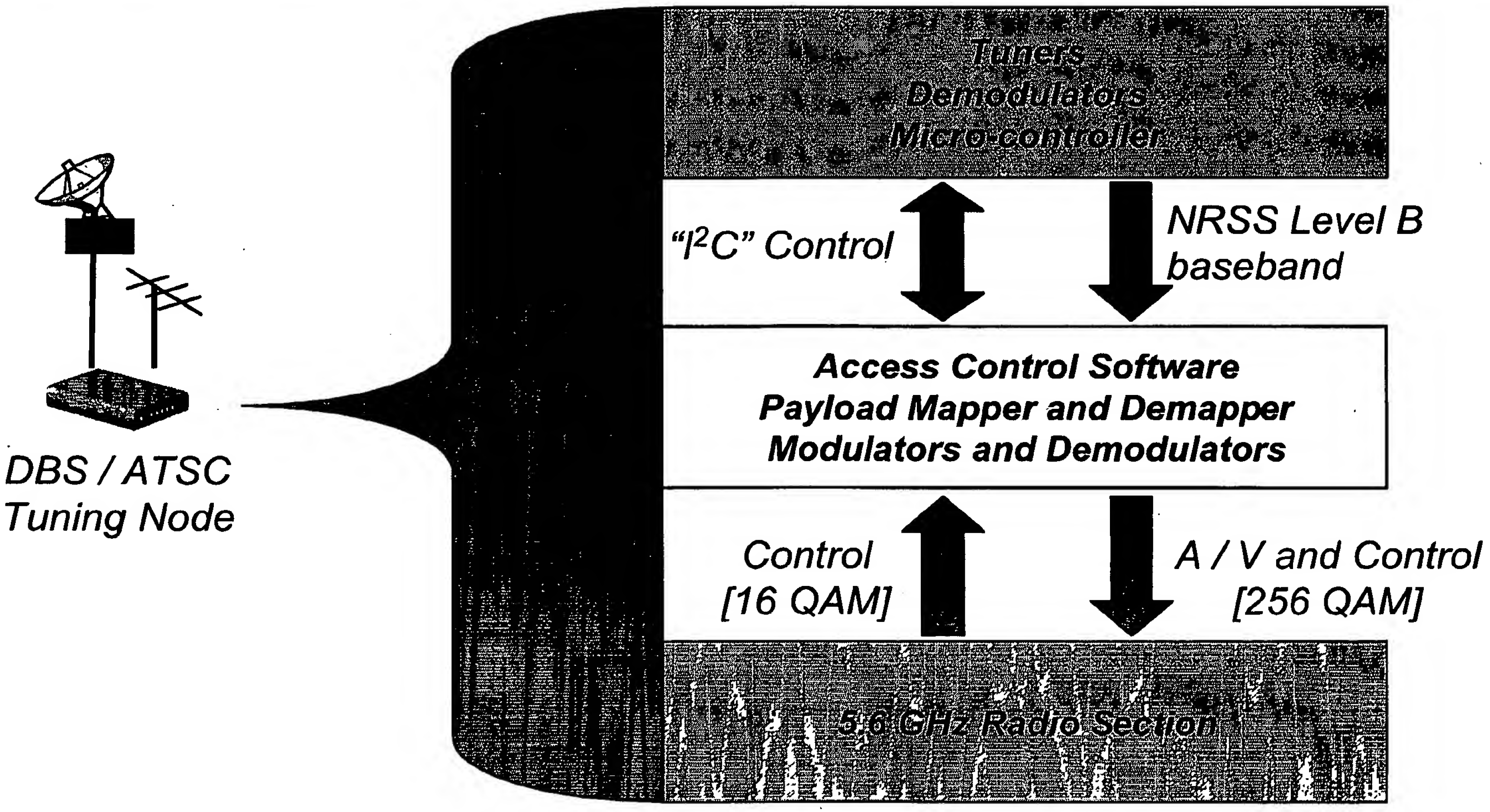
UHF

Integrated Solid State Tuner
$ 3.00

To Digital Demodulator

DBS / ATSC Tuner Node

FIG8



DBS / ATSC
Tuning Node

Tuners
Demodulators
Micro-controller

"I²C" Control

NRSS Level B
baseband

Access Control Software
Payload Mapper and Demapper
Modulators and Demodulators

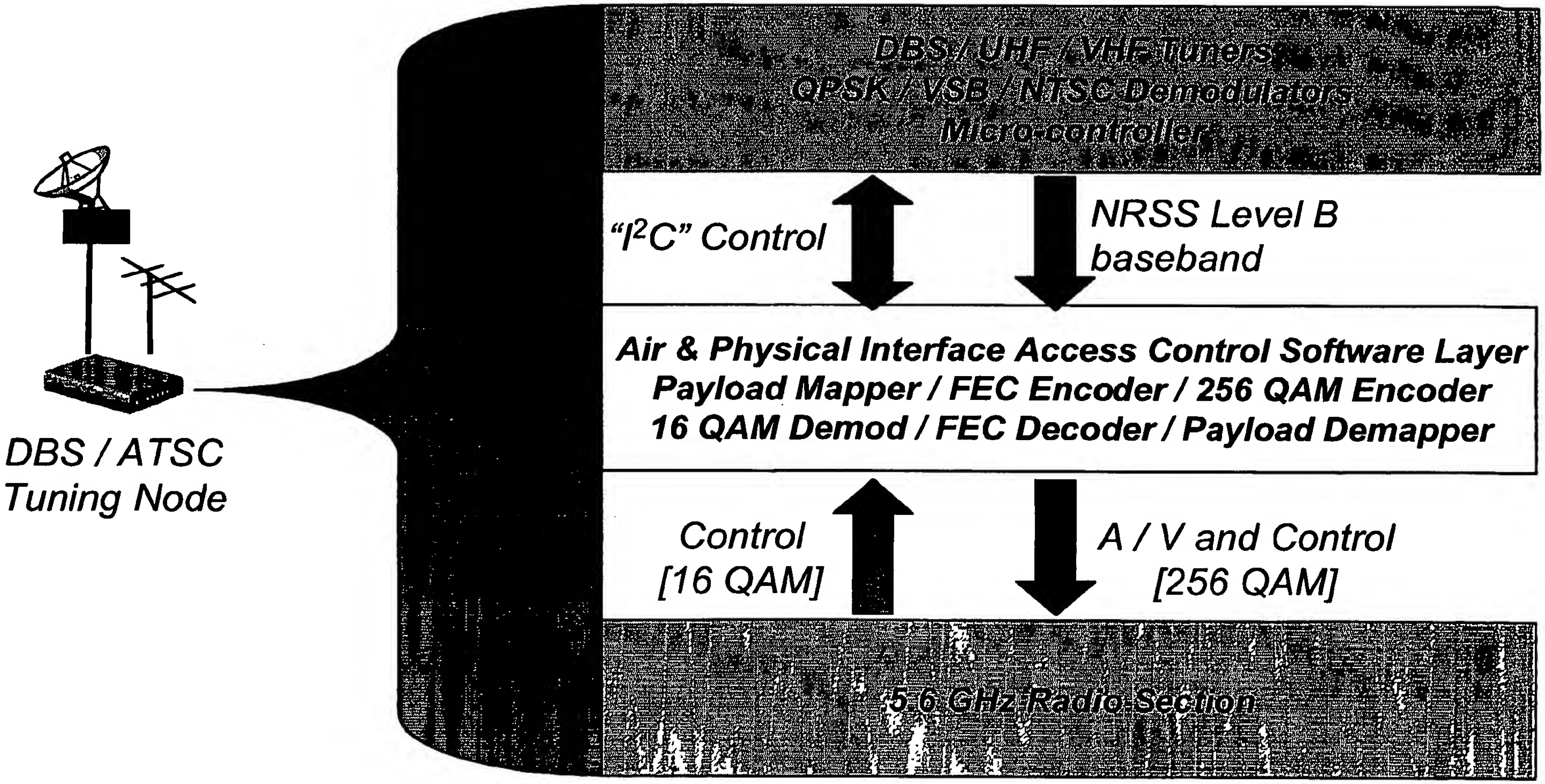
Control
[16 QAM]

A / V and Control
[256 QAM]

5.6 GHz Radio Section

DBS / ATSC Tuner Node

FIG. 9



DBS / ATSC
Tuning Node

DBS / UHF / VHF Tuners
QPSK / VSB / NTSC Demodulators
Micro-controller

"I^2C" Control

*NRSS Level B
baseband*

***Air & Physical Interface Access Control Software Layer
Payload Mapper / FEC Encoder / 256 QAM Encoder
16 QAM Demod / FEC Decoder / Payload Demapper***

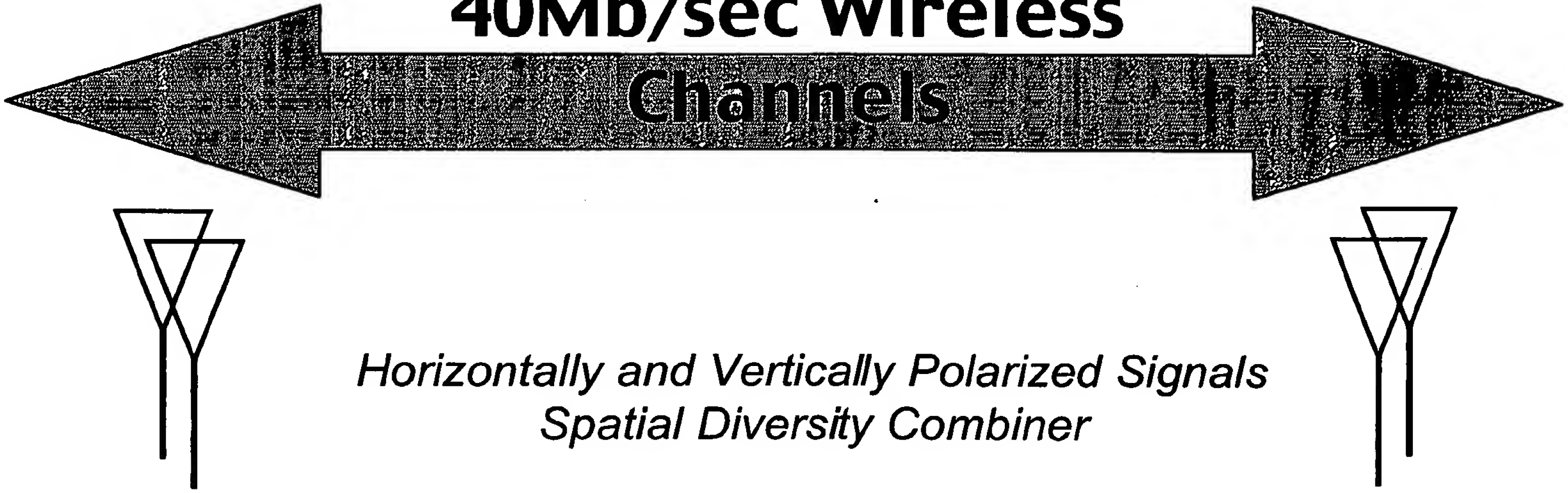
*Control
[16 QAM]*

*A / V and Control
[256 QAM]*

5.6 GHz Radio Section

Architecture

FIG. 10



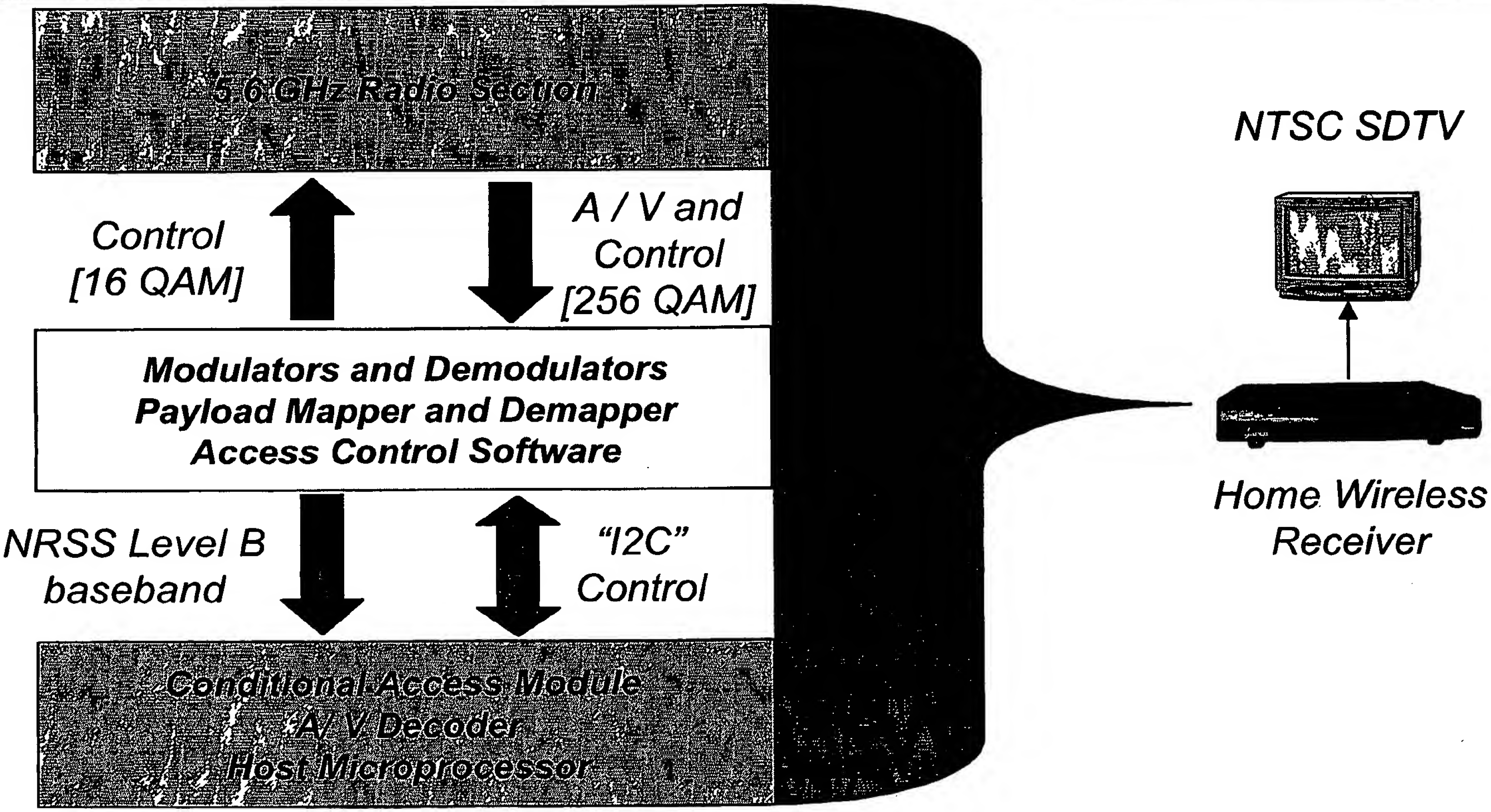
5.6 GHz Broadband
45 two-way channel pairs
CSMA/CD
(carrier sense multiple access with collision detection)

40Mb/sec Wireless
Channels

Horizontally and Vertically Polarized Signals
Spatial Diversity Combiner

DTV Receiver Node

FIG 71



5 6 GHz Radio Section

Control
[16 QAM]

A / V and
Control
[256 QAM]

Modulators and Demodulators
Payload Mapper and Demapper
Access Control Software

NRSS Level B
baseband

"I2C"
Control

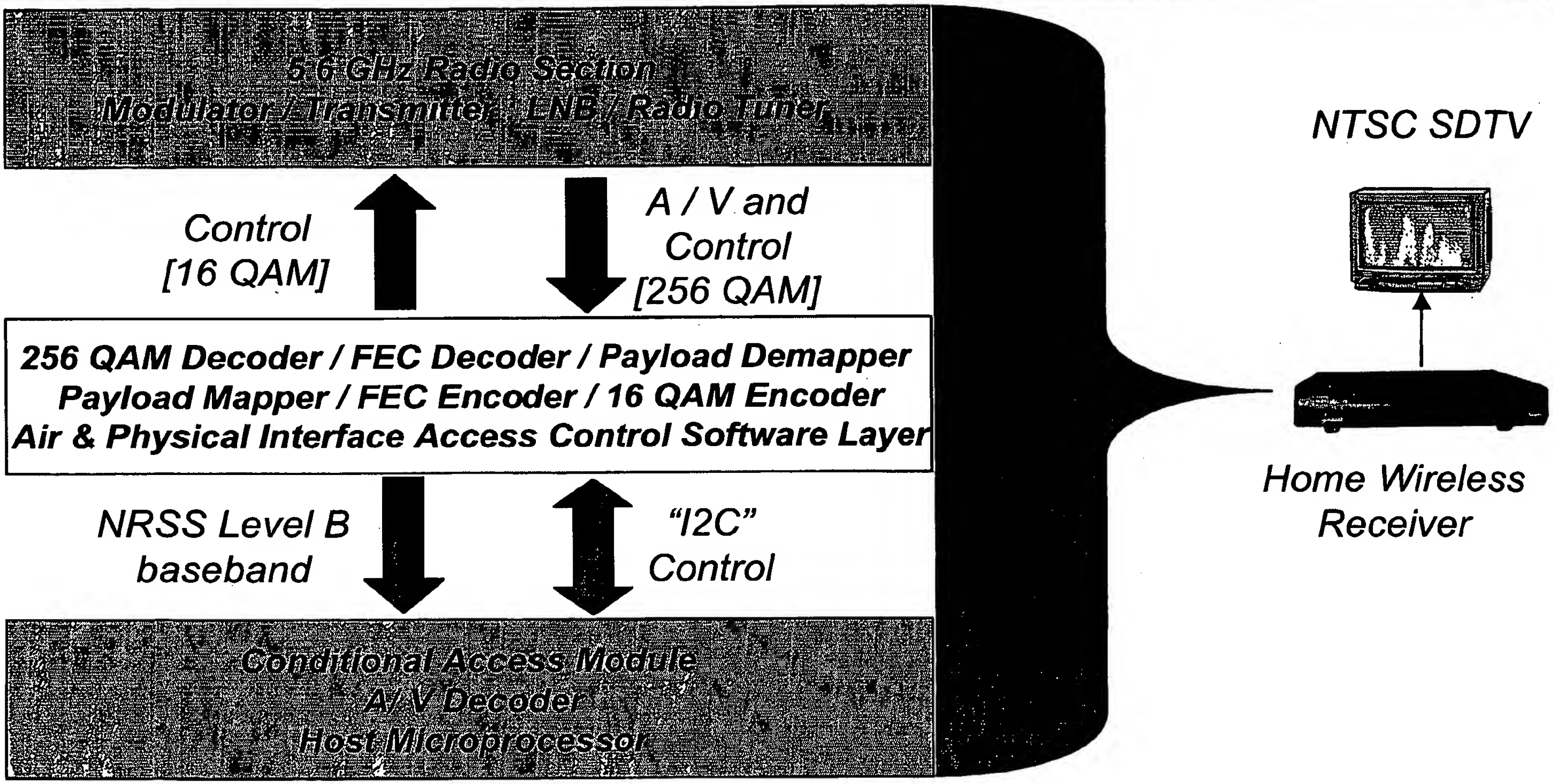
Conditional Access Module
A/ V Decoder
Host Microprocessor

NTSC SDTV

Home Wireless
Receiver

DTV Receiver Node

FIG 12



5.6 GHz Radio Section
Modulator / Transmitter LNB / Radio Tuner

Control
[16 QAM]

A / V and
Control
[256 QAM]

256 QAM Decoder / FEC Decoder / Payload Demapper
Payload Mapper / FEC Encoder / 16 QAM Encoder
Air & Physical Interface Access Control Software Layer

NRSS Level B
baseband

"I2C"
Control

Conditional Access Module
A/V Decoder
Host Microprocessor

NTSC SDTV

Home Wireless
Receiver

QAM Meets System Requirements

FIG 13

- » Data rate: For handling DBS HDTV feeds, channel data rates must approach 40 Megabits/sec.
- » Low cost (<$50 retail adder per node): The overall system architecture must intrinsically enable “low cost.”
- » Near neighbor interference: The total number of available channels must be large enough such that “near neighbors” in apartments, town homes, condos, etc., do not interfere with each other.

Why Not COFDM?

FIG 14

- What COFDM does:
  - Robust in dealing with multipath.
  - But COFDM trades-off multipath for increased bandwidth.
- Larger bandwidth:
  - Introduces stringent demands on the RF circuit designer, and the selection of A/D and D/A signal conversion components [phase noise and linearity].
  - Reduces available channels by 50% -- opens the door wider to potential interference between "near neighbors."
- Increased cost:
  - Higher peak power handling for radios.
  - Higher resolution signal converters.
  - Logic gate counts increased by about 1.5X.

Handling In–Home Multipath with QAM

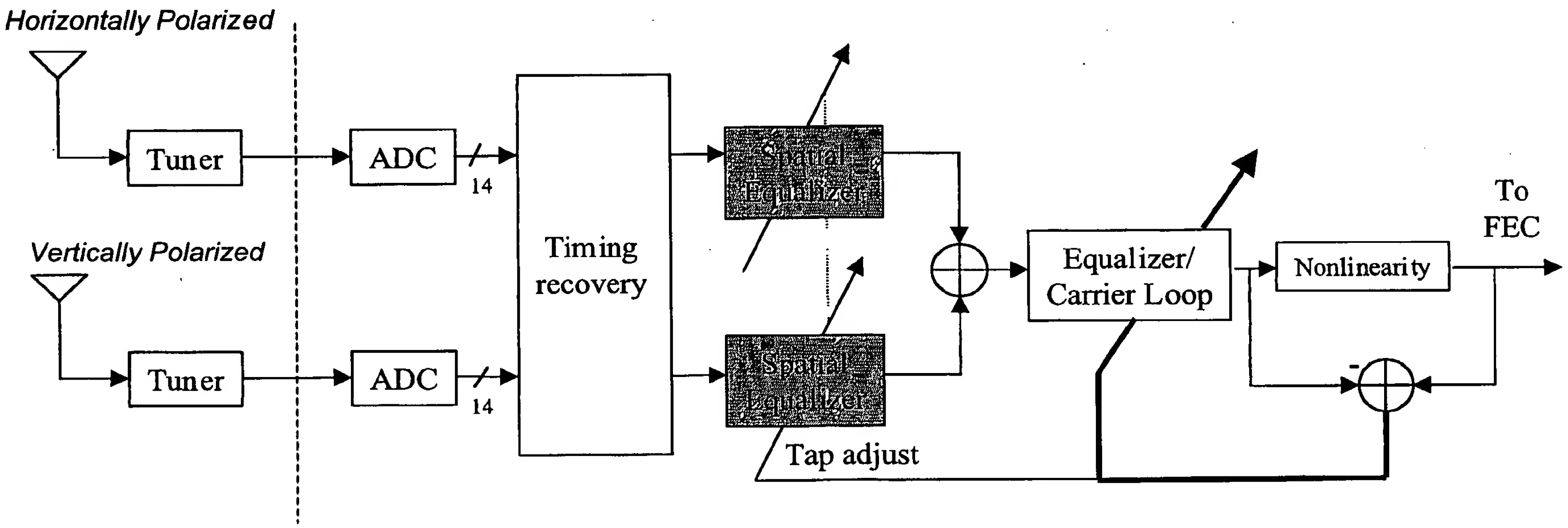
FIG 15

» Increase channel bandwidth on the order of 20%:
  - Increasing channel bandwidth from 6MHz to a little over 7MHz may enable demodulators to deal with higher levels of multipath.

» Reduce the modulation system to 128- or 64-QAM:
  - Reducing size of symbol constellation increases symbol spacing and thus enhances system's ability to deal with elevated channel noise.
  - To maintain 40 Mbps channel rates, must increase bandwidth by ~30%.

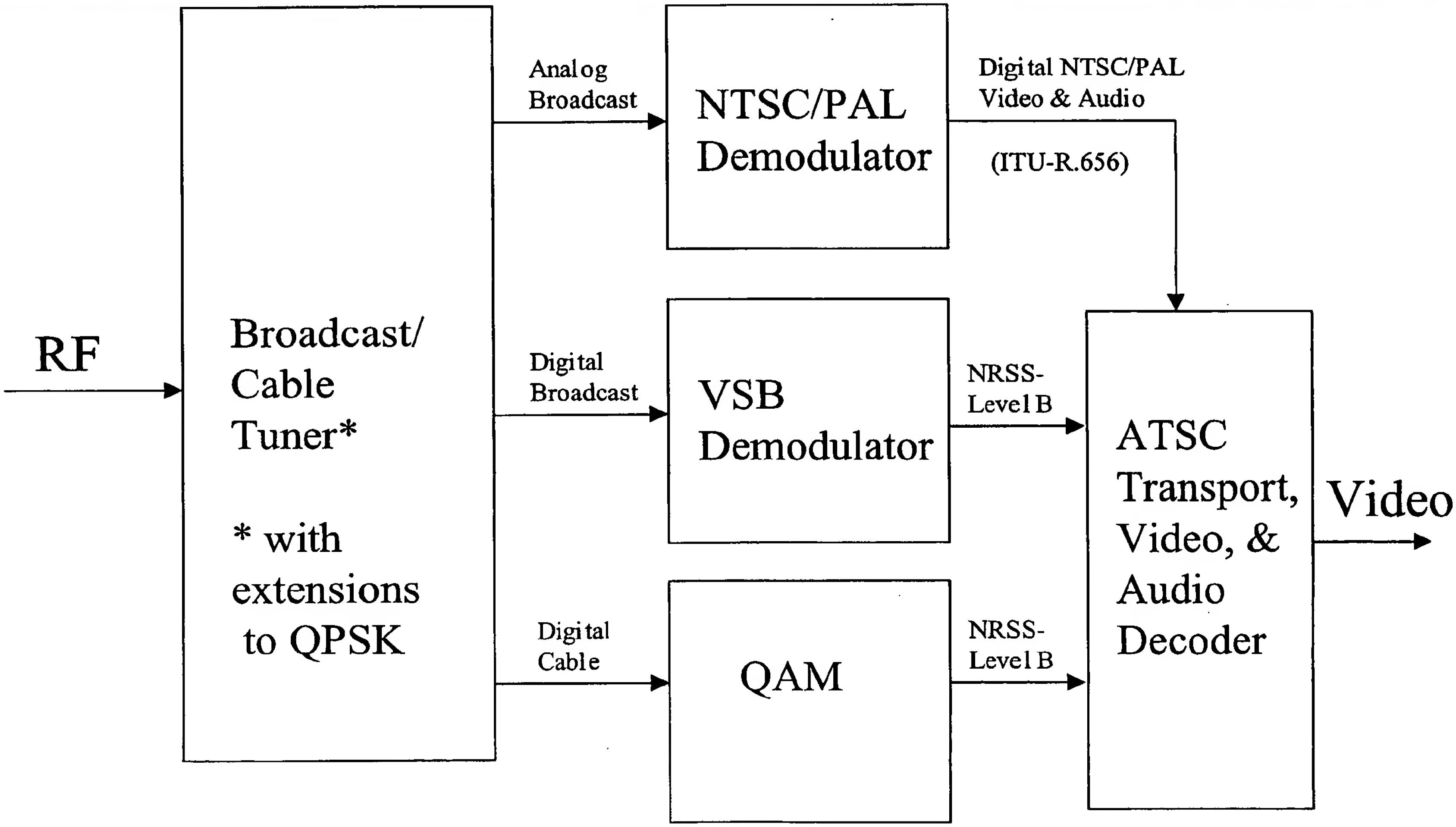
Spatial Diversity Combiner

FIG 16



Discrete Tuner Technology

FIG 17


RF

Broadcast/ Cable Tuner*

* with extensions to QPSK

Analog Broadcast

Digital Broadcast

Digital Cable

NTSC/PAL Demodulator

VSB Demodulator

QAM

Digital NTSC/PAL Video & Audio

(ITU-R.656)

NRSS-Level B

NRSS-Level B

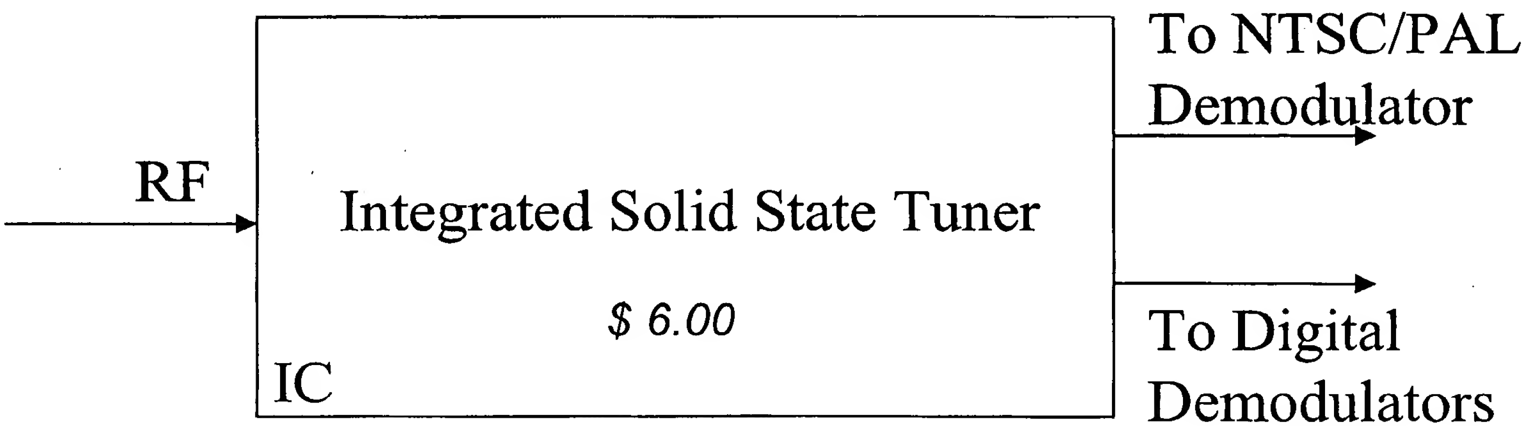
ATSC Transport, Video, & Audio Decoder

Video

Solid State Tuner

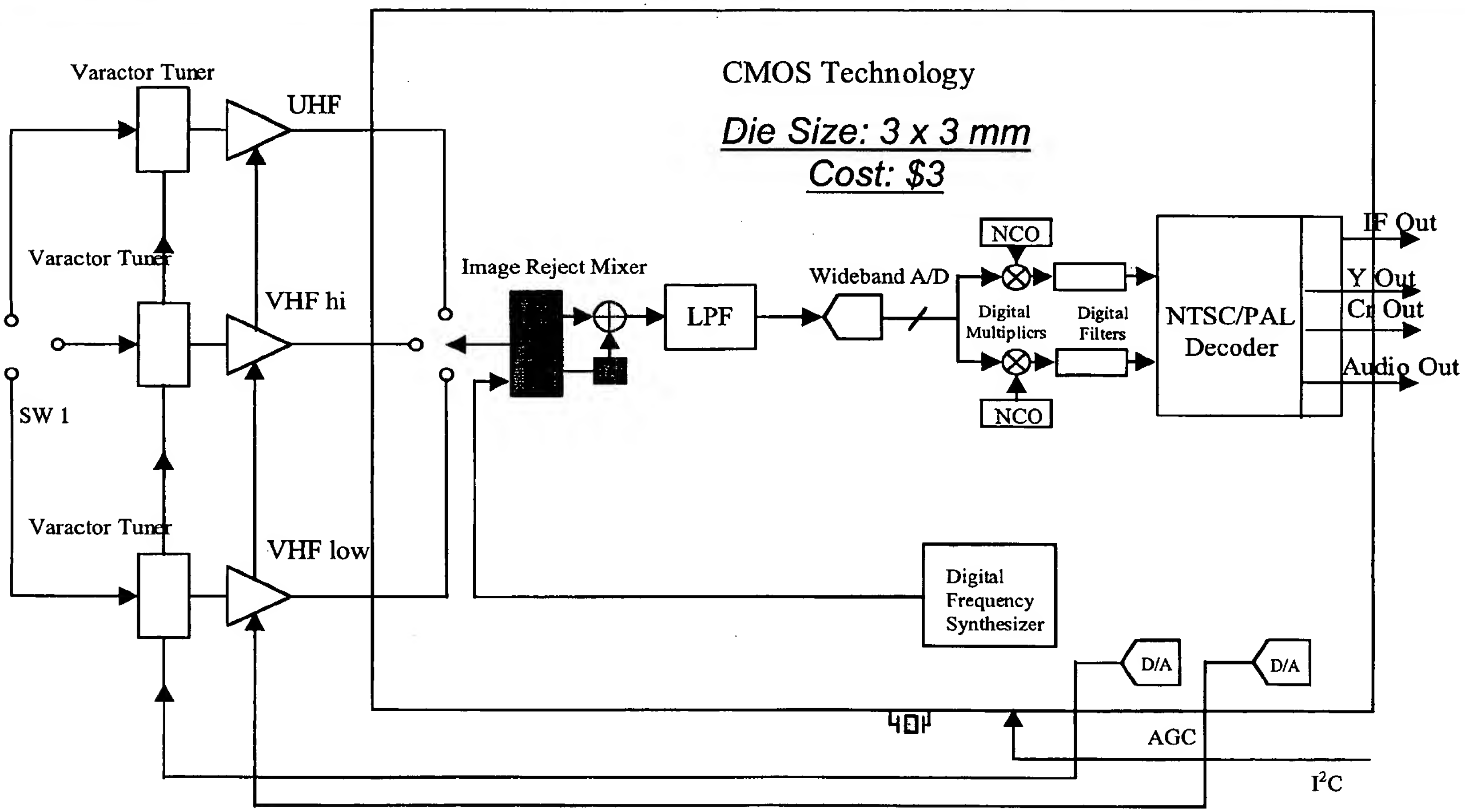
FIG 18

- A Single IC:
  - » RF input and digital outputs to NTSC/PAL and VSB/QAM Digital Demodulators
  - » 2H ‘00 product introduction



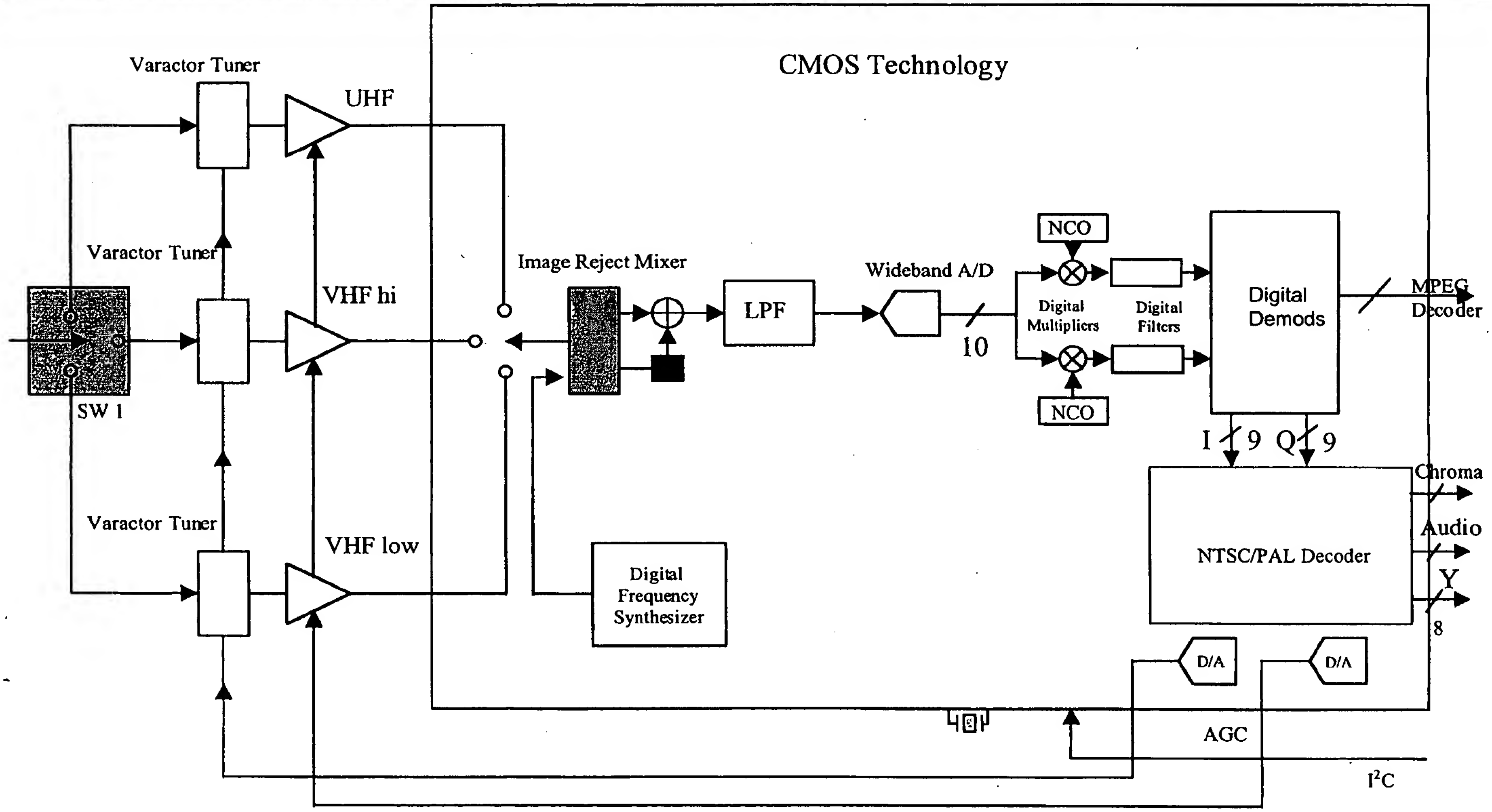
CMOS Solid State Tuner

FIG. 19



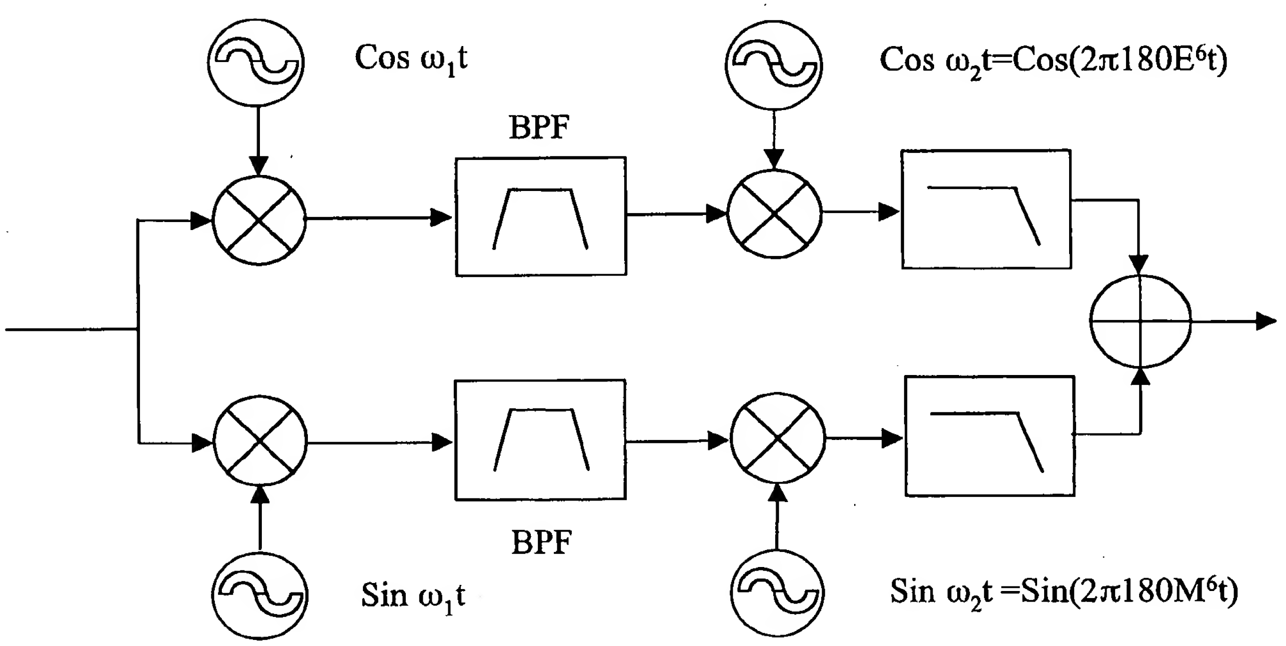
Adding QAM Digital Demodulators

FIG 20



Mixer Architecture

FIG 21



Digital Band Pass Filters

FIG 22

Frequency Response of Digital SAW Filter

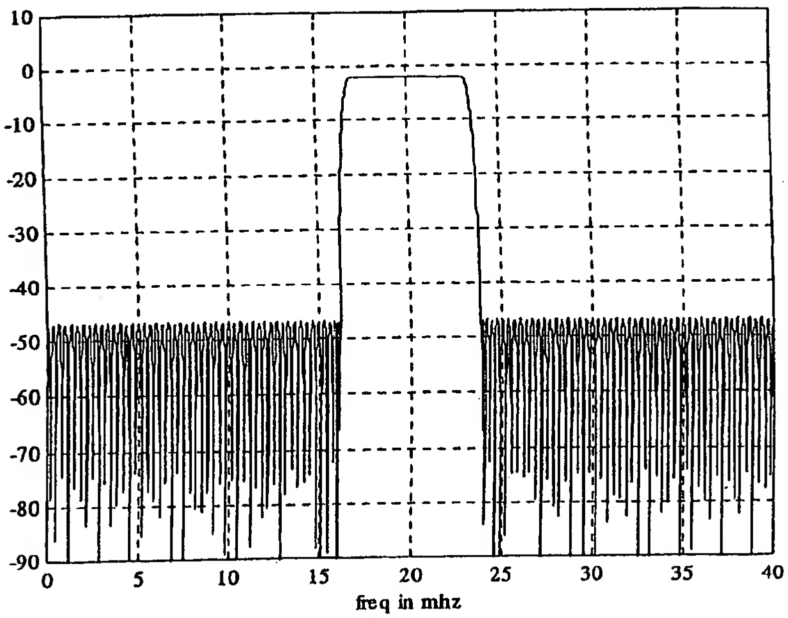


FIG23

Tuner Mixer
First Silicon Results

Mixer Performance

FIG 24

- +3 dB_m IP_3
  - + 5 to +10 dB_m IP_3 in second silicon
- 35 dB of Local Oscillator reverse isolation
- > 30 dB of Local Oscillator suppression
- > 60 dB of on channel suppression

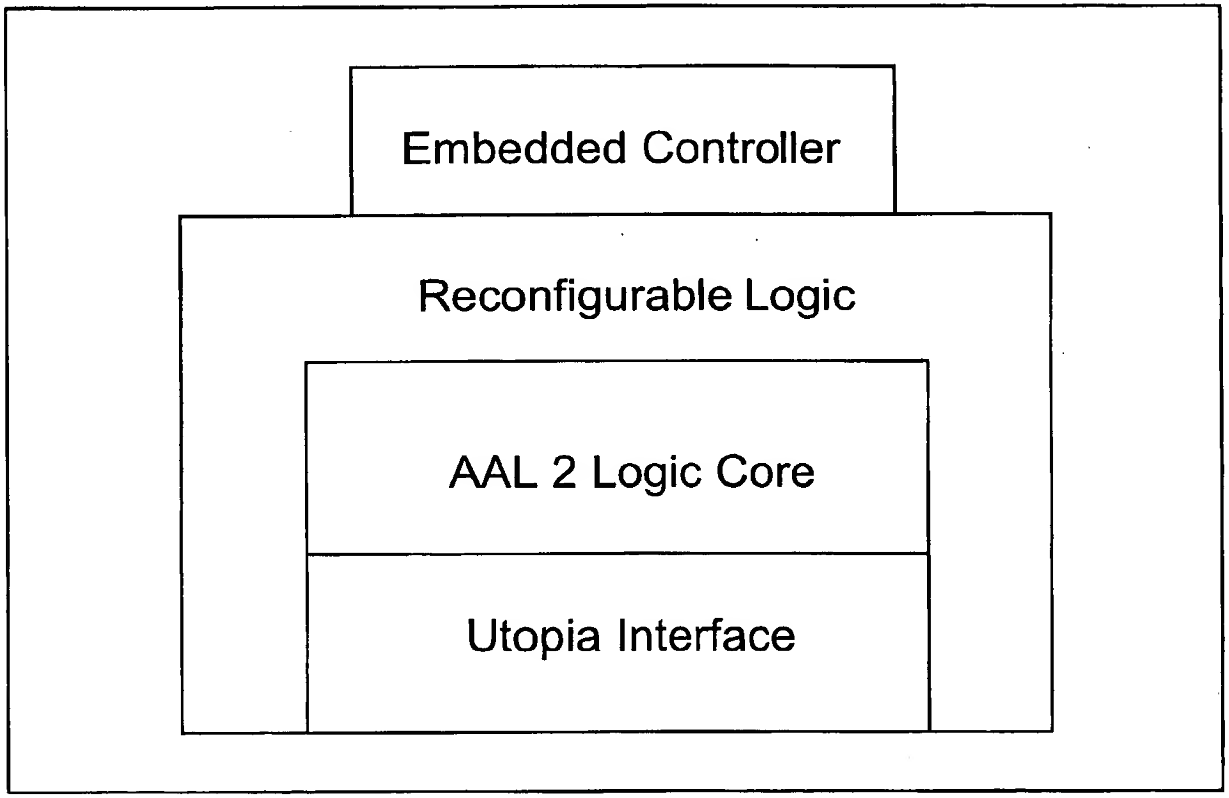
Mixer Performance

FIG 25

● Conversion Capability:	beyond 1.1 GHz
● Conversion Gain:	5 - 10dB
● ESD on RF Pads:	2kV

Appendix I
Reconfigurable ATM Adaptation Layer 2 Router

FIG 26



Embedded Controller

Reconfigurable Logic

AAL 2 Logic Core

Utopia Interface

FIG. 27

Appendix I
Reconfigurable ATM Adaptation Layer 2 Router (Continued)

- The AAL 2 core is the heart of the RAAL 2 Router
- Programmable, or reconfigurable, logic surrounds the core
- Programming is accomplished through the embedded processor unit
- As the home network changes and/or market trends drive hardware and networking technologies, the RAAL 2 device can adapt and scale its capability meet a wider range demands.